

ORIGINAL RESEARCH ARTICLE

PHARMACOLOGICAL MANAGEMENT OF ACUTE RESPIRATORY TRACT INFECTIONS IN EMERGENCY  
DEPARTMENT OF TERTIARY CARE CENTER

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ABSTRACT

**Background:** Acute respiratory tract infection has been recognized as the major cause of morbidity and ranks among the most frequent causes of mortality among the elderly and very young children. This study aimed to assess the pharmacological management of acute respiratory tract infections among patients visiting Emergency Department in Dhulikhel Hospital, Kathmandu University Hospital.

**Methods:** A descriptive, cross sectional study was conducted from August 2019 to January 2020 in patients attending Emergency Department of Dhulikhel Hospital. One hundred and sixty five patients with symptoms of acute respiratory tract infections who visited the same department were included in the study. Entry and analysis of collected data was done in Statistical Package for the Social Sciences 20. Descriptive tests were used, and results were expressed as mean, frequency and percentage.

**Results:** Among 165 patients who visited Emergency department with symptoms of acute respiratory tract infections, majority 137 (83%) had symptoms of shortness of breath, followed by cough 110 (66.7%). Thirty (18.2%) cases were triaged into high acuity (red) zone. Acute exacerbation of chronic obstructive pulmonary disease 118 (71.5%), followed by pneumonia 16 (9.7%) were the most common diagnosis. Intravenous hydrocortisone was the most commonly used pharmacotherapy in 125 (75.8%) patients. Oxygen was most commonly used supportive therapy in 137 (83%) cases. Regarding the outcome, 75 (45.5%) were admitted to wards and 64 (38.8%) were discharged.

**Conclusions:** Most of the acute respiratory tract infections were managed by using intravenous corticosteroid, antibiotics and nebulized bronchodilators.

INTRODUCTION

Acute respiratory tract infection (ARTI) is an acute infection of any part of respiratory tract and related structures including paranasal sinuses, middle ear, and pleural cavity. It includes a diverse group of diseases ranging from self-limiting illness to bronchiolitis and pneumonia that may require emergency medical care.<sup>1</sup>

Management of ARTI in Emergency department (ED) is different from outpatient department as the patients presenting in ED are severely ill which requires prompt treatment.<sup>2</sup> Prompt recognition and appropriate treatment can reduce morbidity and prevent mortality.<sup>3</sup> Antibiotics, bronchodilators, corticosteroids, analgesics, antihistaminics are some of the mainstay in the management of ARTI. Oxygen therapy is also required in hypoxemic cases.<sup>4-6</sup>

The aim of this study was to assess the pharmacological management of ARTI among patients visiting ED of Dhulikhel Hospital, Kathmandu University Hospital (DH-KUH).

METHODS

A descriptive, cross sectional study was conducted in ED of DH-KUH, Kavrepalanchok, Nepal from October 2019 to January 2020. Ethical approval was obtained from the Institutional Review Committee of Kathmandu University School of Medical Sciences (195/19). Among the patients visiting ED, 165 of them, with symptoms of ARTI such as cough, runny nose, sore throat, fever, chills, headache, difficulty breathing/shortness of breath, chest discomfort were included in the study. Diagnosis of ARTI was made by treating physicians in ED of DH-KUH. Underlying respiratory diseases like tuberculosis and malignancy were excluded from the study. Written consent was taken from each participant prior to data collection.

After receiving patients with ARTI in ED, they were triaged into different zones according to the severity of their clinical condition. Red zone: patient requiring immediate life-saving intervention. Orange zone: patient in a serious condition but could wait a few minutes longer. Yellow zone: patient requiring observation, stable condition for the moment and, not in immediate danger of death and would be treated immediately under normal circumstances. Green zone: stable patient requiring minimal care in several hours or days but not immediately.

Data was collected from case records of patients visiting ED with symptoms of ARTI and evaluated for demographic parameters, chief complaint along with presenting symptoms, referral/non referral case, time of arrival, time of discharge, vital signs, triage level, diagnosis, emergency management of ARTI with outcome and were documented in specially designed proforma. Management of ARTI with pharmacotherapies like bronchodilators, corticosteroids, antibiotics along with supportive therapies such as oxygen, diuretics, analgesics were recorded. Route of administration along with dose of those medications were also taken into account. Other information such as history of medicine use for same illness before ED visit was collected from patient/patient party on bedside.

Convenience sampling was used. Statistical package for Social Sciences version 20 was used for data entry and analysis. Descriptive tests were used, and results were expressed as mean, frequency and percentage.

## RESULTS

Out of 165 patients of ARTI included in study, 77 (46.7%) were male and 88 (53.3%) were female. Mean age of patients was 56.7± 26.1 years. Majority 98 (59.4%) of them were from Kavrepalanchok district, followed by Bhaktapur district 24 (14.5%).

Majority 137 (83%) of the patients had symptoms of shortness of breath (SOB), followed by cough 110 (66.7%) (Table 1).

**Table 1: Presenting symptoms of ARTI patients**

Symptoms	n (%)
SOB	137 (83)
Cough	110 (66.7)
Fever	49 (29.7)
Generalized body swelling	36 (21.8)
Orthopnea	34 (20.6)
Chest pain	26 (15.8)
Sore throat	12 (7.3)
Others*	12 (7.3)

\* chills, headache, nasal obstruction

**Table 2: Distribution of ARTI patients in relation to triage level and age**

Age group	Triage level				Total n (%)
	Red	Orange	Yellow	Green	
≤15	3 (1.8)	3 (1.8)	17 (10.3)	0 (0)	23 (13.9)
16-25	1 (0.6)	0 (0)	7 (4.2)	3 (1.8)	11 (6.7)
26-35	1 (0.6)	2 (1.2)	3 (1.8)	0 (0)	6 (3.6)
36-60	4 (2.4)	7 (4.2)	6 (3.6)	0 (0)	17 (10.3)
>60	21 (12.7)	46 (27.9)	40 (24.2)	1 (0.6)	108 (65.4)
Total	30 (18.2)	58 (35.1)	73 (44.2)	4 (2.4)	165 (100)

Mean duration of presenting symptoms was 5.2±7.2 days. Mean ED stay of patient was 4.5±4.2 hours. Mean vital signs during presentation were recorded as, pulse: 101.3±26.6 beats/minute, systolic blood pressure: 123.4±24.6 mm Hg, diastolic

blood pressure: 76.8±15.7 mm Hg, respiratory rate: 24.6±8.7 breaths/minute, oxygen saturation: 79.1±15.6%. Among all the patients of ARTI in ED, 30 (18.2%) were triaged into red zone, out of which 21 (70%) were in the age group of more than 60 years (Table 2).

Majority 118 (71.5%) of the ARTI were diagnosed as acute exacerbation of chronic obstructive pulmonary disease (AECOPD), followed by pneumonia 16 (9.7%) (Table 3).

**Table 3: Diagnosis of ARTI cases in ED**

Diagnosis	n(%)
<b>Lower respiratory tract infections (LRTIs)</b>	
AECOPD	
AECOPD with Type II respiratory failure	45 (27.3)
AECOPD with cor pulmonale	42 (25.5)
AECOPD with consolidation	28 (17.0)
AECOPD with sepsis	3 (1.8)
Pneumonia	16 (9.7)
Acute exacerbation bronchial asthma (AEBA)	10 (6.1)
Others*	4 (2.4)
<b>Upper respiratory tract infections (URTIs)</b>	
Tonsillitis	6 (3.6)
Pharyngitis	2 (1.2)
Sinusitis	1 (0.6)
Unspecified URTI	8 (4.8)
Total	165 (100)

\*Others like bronchiolitis/pneumothorax/lung abscess

**Table 4: Pharmacological management of ARTI in ED**

Management	n (%)
<b>Steroids</b>	
IV Hydrocortisone	125 (75.8)
Nebulized fluticasone	9 (5.5)
<b>Bronchodilators</b>	
Nebulized A:I:NS	93 (56.4)
Nebulized ipratropium bromide:normal saline (I:NS)	6 (3.6)
Nebulized adrenaline	4 (2.4)
Nebulized albuterol	2 (1.2)
<b>Antibiotics</b>	
IV ceftriaxone	73 (44.2)
IV/tablet amoxicillin/clavulanic acid	16 (9.7)
Other antibiotics (IV meropenam/IV metronidazole/IV piperacillin –tazobactam/IV levofloxacin/IV piperacillin/IV ampicillin/IV amikacin)	13 (7.9)
<b>Supportive therapy</b>	
IV Pantoprazole	109 (66.1)
IV Furosemide	56 (33.9)
Oxygen	137 (83)
IV Magnesium sulphate	21 (12.7)
IV/suppository Paracetamol	10 (6.1)
IV Calcium gluconate	6 (3.6)
Others*	6 (3.6)

\*IV nor adrenaline/IV ketorolac/tablet levocetizine

Among all the patients with ARTI in ED, emergency management was done by intravenous (IV) hydrocortisone in 125

(75.8%) patients, and most of them 115 (92%) were used in the management of AECOPD. Antibiotics was an important category and it was administered in 102 (61.8%) patients. Among all antibiotics, IV ceftriaxone (ATC code: J01DD04) was administered in 73 (44.2%) patients. Combination of broncho-

dilator, nebulized albuterol:ipratropiumbromide:normal saline (A:I:NS) was used in 93 (56.4%) patients. Among the supportive therapy used, oxygen was most commonly used in 137 (83%) patients (Table 4 and 5). Seventy five (45.5%) patients were admitted to wards and 64 (38.8%) were discharged (Table 6).

**Table 5: Pharmacological management of ARTI based on diagnosis**

Management	COPD	Pneumonia	AEBA	URTI	Others	Total n (%)
IV hydrocortisone	109 (66.1)	7 (4.2)	7 (4.2)	-	2 (1.2)	125 (75.8)
Nebulized A:I:NS	78 (47.3)	3 (1.8)	8 (4.8)	-	4 (2.4)	93 (56.4)
IV ceftriaxone	55 (33.3)	12 (7.3)	2 (1.2)	-	4 (2.4)	73 (44.2)
IVamoxicillin +clavulanic acid	3 (1.8)	-	-	13 (7.9)	-	16 (9.7)
IV Pantoprazole	91 (55.2)	8 (4.8)	7 (4.2)	2 (1.2)	1 (0.6)	108 (66.1)
IV Furosemide	49 (29.7)	6 (3.6)	1 (0.6)	-	-	56 (33.9)
Oxygen	114 (69.1)	13 (7.9)	8 (4.8)	-	2 (1.2)	137 (83)
IV Magnesium sulfate	19 (11.5)	2 (1.2)	-	-	-	21 (12.7)

**Table 6: Outcome of ARTI patients in ED**

Outcome	n (%)
Discharged	64 (38.8)
Admitted to wards	
Medicine ward	63 (38.2)
Pediatric ward	10 (6.1)
ENT ward	2 (1.2)
Intensive care unit (ICU)	
Adult ICU	7 (4.2)
Pediatric ICU	2 (1.2)
Referred	9 (5.5)
Discharge on request	5 (3)
Left against medical advice	3 (1.8)
Total	165 (100)

## DISCUSSION

ARTI has been recognized as the major cause of morbidity and ranks among the most frequent causes of mortality among the elderly and very young children.<sup>7</sup> In the present study, LRTI were more common than URTI in ED which was similar to the study where LRTI encounters were more than URTI. URTI are mostly self-limiting, although complications result from viral aetiologies. LRTI are generally more serious than URTI and are leading cause of death among all infectious diseases.<sup>8</sup>

In this study, the mean age was 56.7±26.2 years. According to study done by Gonzales et al,<sup>10</sup> almost half of all ARTI visits to ED were by patients aged 18-44 years, whereas in another study conducted by Donnelly et al,<sup>9</sup> the mean age of ARTI patient was 21.1 years. In the present study, female represented more than half the total patients. The data was similar to the study<sup>7</sup> in which prevalence of majority of ARTI patients in ED were female. The average length of stay of ARTI patient in ED was 4.5± 4.2 hours. In the study conducted by Gonzales et al,<sup>10</sup> half of the patients with ARTI spent more than 2.25 hours being evaluated and treated in ED.

In this study, average duration of presenting symptoms before visiting ED was 5.23±7.26 days. Most patients sought

care within two to seven days of illness onset.<sup>10</sup> In our study, patients who visited ED with symptoms of ARTI, majority had symptoms of SOB, followed by cough. Similar study found most common symptoms to be cough, followed by sore throat.<sup>11</sup> In the present study, most common diagnosis was AECOPD followed by pneumonia. Nonspecific upper respiratory tract infections, followed by acute bronchitis were the most common diagnoses, accounting for nearly two thirds of the total sample.<sup>10</sup>

Corticosteroids such as inhalational budesonide, beclomethasone and iv hydrocortisone with or without bronchodilators such as systemic or inhalational beta-2 sympathomimetics and anticholinergics are widely used to treat respiratory diseases such as moderate to severe attacks of bronchial asthma and COPD. Although corticosteroids exert a beneficial effect on the course of different acute respiratory diseases, type of corticosteroid and its appropriate dosage should be carefully evaluated in order to minimize potential adverse effects.<sup>12</sup> In the present study, almost all patients with LRTI including AECOPD, pneumonia, AEBA were managed by use of iv hydrocortisone stat in a dose of 100-400 mg. In the study,<sup>13</sup> where patients were randomized to receive iv hydrocortisone in a dose of 100 mg iv 6 hourly in one group whereas oral prednisolone 100 mg once daily for 72 hours following admission for treatment of bronchial asthma had similar efficacy. IV corticosteroids are used in practice for the treatment of ARTI, but they may not offer any advantage over oral corticosteroids in terms of cost effectiveness and length of hospital stay.<sup>14</sup>

Out of all patients with LRTI in ED, majority were treated with combination of two bronchodilators (albuterol with ipratropium bromide) along with normal saline. Ratio of nebulized A:I:NS was in a range between 1:1:1, 1:1:2, 1:2:3. According to the study,<sup>15</sup> combination of nebulized albuterol along with ipratropium bromide in treatment of LRTI was found to be in 38.7% cases. Use of inhalational normal saline assist sputum expectoration and relieve breathlessness in patients with brochospasm.<sup>16</sup> The addition of nebulized ipratropium to standard beta-2 sympathomimetics for treatment of COPD exacerbations and acute asthma provides better bronchodilation than either therapy alone without increasing side effects.<sup>17</sup> However, there

was no statistically significant difference in outcome between ED patients with acute bronchospasm receiving continuous albuterol plus ipratropium bromide and those receiving albuterol alone.<sup>18</sup>

In the study conducted by Donnelly et al,<sup>9</sup> there were 126 million ED visits with a diagnosis of ARTI, and antibiotics were prescribed in more than half of the cases. In another study,<sup>10</sup> approximately one third of acute bronchitis and more than one fourth of URTI visits were treated with antibiotics. In this study, ceftriaxone in a dose of 1-2 gm iv stat was the most commonly used antibiotics for the treatment of LRTI. Management of LRTI with ceftriaxone, a third generation cephalosporin, has a broad spectrum of activity against Gram-positive and Gram-negative aerobic, and some anaerobic bacteria. Use of ceftriaxone has showed complete resolution or improvement in clinical signs and symptoms in most of the patients with LRTI.<sup>19</sup> According to study,<sup>20</sup> one gm once daily iv ceftriaxone is as effective as iv cefuroxime and amoxicillin/clavulanic acid in the treatment of LRTI and also, its use reduces treatment costs, in view of the multiple daily dosing regimens of most standard therapies.<sup>20</sup> However, when adverse drug reactions were taken into account, iv/oral fluoroquinolone, ciprofloxacin was better tolerated than iv ceftriaxone in the management of LRTI.<sup>21</sup> Amoxicillin/clavulanate used by oral route was as effective as iv amoxicillin/clavulanate and third generation cephalosporin in the treatment of LRTI.<sup>22</sup> Similarly, out of all URTI, majority were managed with amoxicillin/clavulanate. In the study carried out in Trinidad, most URTI was frequently managed by antibiotics, amoxicillin, followed by amoxicillin/clavulanate.<sup>23</sup> Viruses are responsible for the great majority of URTIs, therefore antimicrobial treatment is not always required. Inappropriate use of antibiotics can potentiate the worldwide trend of antimicrobial resistance. Institution of measures to reduce inappropriate antibiotic use in the ED setting is recommended by focusing on appropriate microbial cultures and correct choice and doses of antibiotics needs to be increased.<sup>7</sup> Recent literature highlights the success of antimicrobial stewardship programs (ASPs) to reduce antimicrobial resistance, health care costs, and drug-related adverse events while improving clinical outcomes.<sup>24</sup>

Oxygen therapy plays an important part in treating severe LRTIs. Hypoxaemia with LRTI has been associated with increased risk of mortality and long-term morbidity.<sup>25</sup> Oxygen is recommended in patients with hypoxia to maintain oxygen saturation >90%. Humidified oxygen helps relieve dyspnea, aids in bronchodilation, and supports the myocardium in acute asthma.<sup>26</sup> In this study, almost all cases of LRTI were managed with supplemental oxygen administered through nasal prongs/face mask.

In this study, more than half of ARTI were managed by

administering proton pump inhibitor (PPI), iv pantoprazole 40 mg iv stat. Bacterial as well as several viruses such as human rhinovirus have been reported to be associated with exacerbation of COPD. Administration of (PPI) suppresses viral infections, and hence is associated with reduction of COPD exacerbation. PPI has been also reported to act as anti inflammatory agent, inhibit cytokine production, and are expected to reduce the frequency of COPD exacerbation.<sup>27</sup> However, in the study done by Holbrook, et al, showed that asthma symptoms did not improve in patients taking PPI compared with those taking placebo.<sup>28</sup>

Diuretics may improve respiratory health outcomes in COPD through several possible mechanisms. Diuretics may reduce pulmonary hypertension and cor pulmonale by decreasing preload to the heart and they can also reduce pulmonary edema.<sup>29</sup> Presence of pulmonary hypertension in COPD is associated with increased mortality risk and symptoms related to excessive fluid overload may lead an individual with COPD to present to hospital for acute care. <sup>30</sup> In the present study, more than one-fourth of LRTI were managed with furosemide 20-40 mg iv stat along with other therapies. Regarding the outcome of ARTI patients in ED, 45.5% were admitted to wards, 38.8% patients were discharged, 5.4 % were admitted to ICU. In a study conducted by Gonzales R, 88% were discharged home, 11% were admitted or transferred to another facility, and 0.1% died.<sup>10</sup>

The study was conducted in only one center with small sample size. Details regarding dosing frequency were not recorded. So, further studies are required to cover this factor. Convenience sampling method was used, which could have led to selection bias of research participants. This limitation could have been prevented by using random sampling.

## CONCLUSION

Pharmacological management of most of the acute respiratory tract infections were done by administering intravenous corticosteroid, antibiotics and nebulized bronchodilators. Interventions to consider use of oral corticosteroid as an alternative to intravenous corticosteroid and reducing inappropriate use of antibiotics should be implemented for the management of acute respiratory tract infections in the Emergency department.

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